United States Department of Agriculture | Forest Service | Northeastern Area State & Private Forestry | 180 Canfield Street Morgantown, WV 26505-3101

File Code: 3460

Date: April 22, 1997

Sharon Nygaard-Scott
District Ranger
Athens Ranger District
Wayne National Forest
219 Columbus Road
Athens, OH 45701-1399

Dear Ms. Nygaard-Scott:

Over the past few months we have been working with Phil Perry to evaluate the potential impacts of gypsy moth in the Dorr Run Management Area. We are pleased to report that we've completed the analysis and have enclosed a summary for your consideration.

We hope this information will prove usefull in the preparation of the Dorr Run Environmental Assessment. Please feel free to call us if you have any questions or require further information.

Sincerely,

BRADLEY P. ONKEN
Entomologist
Forest Health Protection

JIM COLBERT
Mathematician
Northeast Forest Experiment Station

cc: Phil Perry

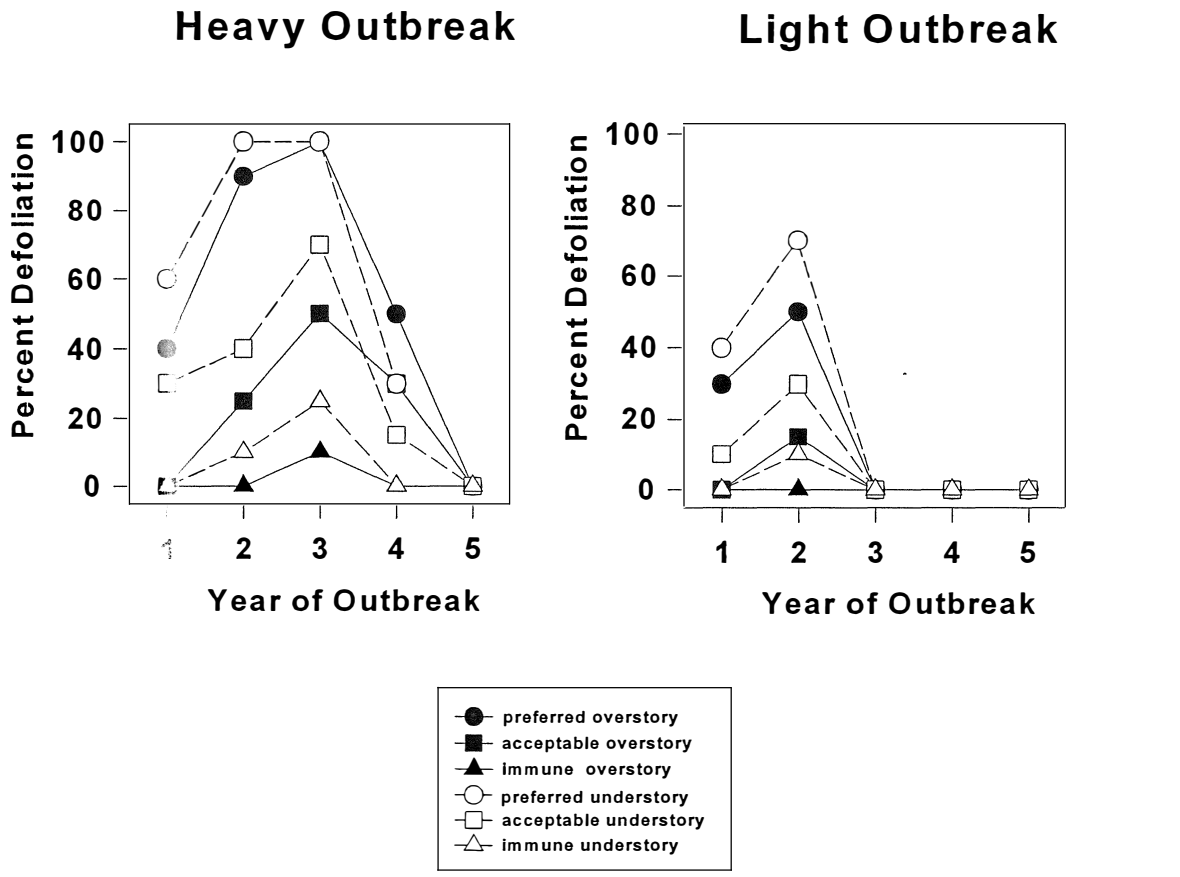
Enclosure

Gypsy moth and potential impacts to the Dorr Run Management Area

Gypsy moth has been spreading from its origin of introduction in North America and is currently established in western Pennsylvania, most of West Virginia, and northeastern Ohio (Liebhold et al. 1997). Gypsy moth is expected to become established in and around the Wayne National Forest in the coming decade. As populations first get established in a new area, this insect does significant damage, due in part to the lack of co-establishment of all of its natural enemy complex. It is expected that losses will occur in Ohio similar to those found over the past two decades in western Pennsylvania.

To assess the possible damage caused by future gypsy moth outbreaks in the Dorr Run area of the Wayne National Forest, we chose a sample consisting of thirty eight stands that were well distributed across six compartments and the four principle forest types that the gypsy moth is known to find most preferable, representing both the spatial mixture and the ecological range of potential impacts. We investigated potential losses by producing a series of stand growth and defoliation scenarios using the Gypsy Moth Stand-Damage Model. First, the model was used to grow all tree data from previous inventories forward through 1996 to represent the current condition of each stand. Growth scenarios, each a 10-year projection, were then constructed to estimate potential tree mortality. Simulations were run with and without defoliation and following selected silvicultural activities. In each case, a no-defoliation scenario was used as the control to base the effects of defoliation upon each variable, summarized to the stand level in 2007, at the end of the simulation. Stem counts, relative density, basal area, and board-foot volumes were used to characterize each stand. Heavy and light defoliation scenarios were used that were similar in duration and intensity to those developed for loss assessments in the National Gypsy Moth Environmental Impact Statement (1995). Each decade simulation consisted of two 5-year outbreak cycles, as shown in the following table. The amount of defoliation to a particular tree depended upon its location in the stand canopy and the feeding preference of gypsy moth to that tree species (Liebhold et al. 1995).

Figure 1. Defoliation scenarios for each 5-year cycle--two cycles are assumed in the 10-year projections, showing differences between feeding preference classes and canopy strata.



To ascertain how silvicultural manipulations to reduce potential gypsy moth impacts could improve these stands, we first need base-line information on the range of potential impacts. To obtain these base-line data, each stand was projected forward under none, light, and heavy outbreak scenarios. These data provide the basis for measuring the utility of silvicultural activities. By summarizing the means and extremes across these stands, we obtain the most probable boundary conditions and the basis for measuring management effects. The following table provides estimates of these conditions on a per acre basis.

Table 1. Losses estimates from all 38 stands following outbreaks.

Stand Category	Trees Lost	Stocking Reduction	Basal Area Loss	Volume Loss
	trees/ac	percentage	sq. ft./ac	MBF/ac
			Heavy Outbreak	
Average	55.9	45.2	52.0	3.0
Best	[44.0]	19.0	19.5	0.7
Worst	383.0	79.0	84.1	5.1
			Light Outbreak	
Average	19.5	6.8	7.7	0.4
Best	0.0	1.0	1.5	0.0
Worst	179.0	21.0	22.3	1.5

Note: the brackets indicate a net gain rather than a loss, here and in following tables.

These estimates provide a view of the possible range of outcomes in susceptible stands as gypsy moth becomes established in the Dorr Run area. Losses can be expected to range from a low of twenty percent to over eighty percent in stands heavily dominated by preferred host species, with average losses per acre over the entire area expected to be above 50 square feet of basal area or nearly 3,000 board feet per acre.

The entries provided in tables 1-5 were obtained as follows: first the totals across all trees in each stand simulation was calculated, then the loss in each stand was calculated as the difference between the outbreak and the no-outbreak totals. E.g., the basal area is calculated and summed for all trees in each stand for each of the three simulations (no defoliation, heavy, and light outbreak), then the difference between totals is calculated on a stand-by-stand basis (heavy minus none and light minus none), and finally the mean of these differences in basal area is presented here, as the average loss in basal area. Best and worst stand totals are also reported as indicators of the range of variability among the stands used in this study. Here the stand that survived the heavy outbreak with the smallest loss of 19.5 sq. ft., did the best and the stand that lost 84.1 sq. ft. of basal area did the worst.

Regeneration was included in these simulations. In the Trees Lost column, the "loss" of trees actually includes the compensation by ingrowth predictions, that is, new trees filling the voids as trees are killed. Understanding these differences requires some careful interpretation and detailed review however, as replacement trees are often a different species from those lost. Since defoliation and any consequent tree mortality will inhibit both mast production and stump sprouting, new trees will likely be species not favored by the gypsy moth or light seeded species from surrounding areas. Even as the number of trees increase in a few stands, these new trees are very small and represent

natural regeneration. While tree counts may decline minimally or increase, stocking (a measure of the trees ability to fully occupy the growing space) is reduced significantly. Closely paralleling stocking, the changes in basal area best reflects the losses of the larger trees. The changes in volume per acre (measured here in thousands of board-feet [MBF]) indicate that losses of valuable trees are significant, based on market prices as of December 1996, losses may run as high as $381.00/ac from severe outbreaks with an average loss of $245.10/ac.

To permit direct contrasts between silvicultural prescriptions and no management, we again summarized these data using just those stands that would qualify for all management prescriptions. To qualify for thinning to 80 percent stocking, a stand was required to be at least 90 percent of fully stocked in 1997. There were 24 stands that qualified. These more heavily stocked stands also tend to show higher average losses.

Table 2. Losses estimates for the 24 heavily stocked stands that qualified for both treatments.

Stand Category	Trees Lost	Stocking Reduction	Basal Area Loss	Volume Loss
	trees/ac	percentage	sq. ft./ac	MBF/ac
			Heavy Outbreak	
Average	69.1	55.4	62.2	3.8
Best	[22.0]	35.0	41.2	2.4
Worst	383.0	79.0	84.1	5.1
			Light Outbreak	
Average	21.4	9.3	10.4	0.6
Best	2.0	2.0	2.9	0.1
Worst	179.0	21.0	22.3	1.5

Comparing Tables 1 and 2, one can see that the stands with lower stocking levels also would be affected less by defoliation. The average losses increased as well as the those for the best stand. In these heavier stocked stands, expected losses will be 20% higher than the general average and volume losses are expected to increase over 25% to nearly 4,000 board-feet per acre. Silvicultural treatment, removing the most susceptible trees, provides growing space to permit the residual stand to become healthier, more resistant to defoliation as growth rates increase.

Presalvage Treatment Alternatives

In the two presalvage treatments considered in this analysis, we assumed that the trees to be removed would be those most likely to be killed by gypsy moth defoliation (Gottschalk 1993, Gottschalk and MacFarlane 1992). Gypsy moth tends to kill higher proportions of the low vigor trees. While tree vigor ratings have not been done in these particular stands, established estimates of tree vigor were used from similar stands in Pennsylvania where the rate of tree mortality was measured as the gypsy moth established itself over the past two decades (Gottschalk et al. 1997 in press). These stands were comparable in species composition, stand density and site conditions and it is expected that similar patterns of defoliation and losses will occur in the coming decade in the Dorr Run area. Vigor is rated using a three class system (Gottschalk and MacFarlane 1992) that provides significant differences in mortality prediction power by species groupings, canopy position, and defoliation intensity (Gottschalk et al. 1996 in press, Colbert 1996 in review). Tree vigor rating was the strongest predictive variable, followed by the canopy position of a tree, while species group and defoliation showed nearly equal but slightly less significance predictive power.

We first consider minimal intervention, removing only the most vulnerable trees from the most heavily stocked stands. To make that assessment we started with the same 1997 conditions and interposed the removal of those trees that appear to be most likely to be killed by future gypsy moth outbreaks (trees with dieback or poor vigor). Twenty-four of the thirty-eight sample stands were sufficiently overstocked (relative density greater than 90 percent of fully stocked, Stout and Nyland 1986) to be considered for minimal removals to the 80-percent line. Following the removal of those trees, we again grew the stands forward 10 years to look for changes in the descriptive measures provided above. Three projections were run over the same 10-year period following simulated presalvage entries in 1997.

Table 3. Losses due to gypsy moth defoliation following presale thinning to the 80-percent for the 24 stands that are at least 90 percent fully stocked in 1997.

Stand Category	Trees Lost	Stocking Reduction	Basal Area	Volume Loss
	trees/ac	percentage	sq. ft./ac	MBF/ac
		Heavy Outbreak		
Average	[60.1]	38.0	43.5	2.9
Best	[106.0]	30.0	34.9	2.4
Worst	[26.0]	53.0	56.4	3.6
		Light Outbreak		
Average	[1.6]	2.8	3.4	0.3
Best	[10.0]	1.0	2.0	0.1
Worst	1.0	5.0	5.7	0.5

The most obvious effect is that removals done as presalvage thinning will not only save residual stocking, but will increase the number of trees significantly. Many of the new trees will be of the same species as the trees removed since the root systems of live cut trees will allow for stump sprouting to occur. Note that this minimal presalvage harvest also saves, on average, 8.5 sq. ft./ac (52.0-43.5) of basal area and increases relative stocking by 7.2%. These translate into a relative increase of 16% over the no action alternative. That is, there can be an expected saving of 16% of the residual basal area that would otherwise be lost due to severe gypsy moth defoliation. It should also be noted that these differences do not consider those trees removed during the thinning operations.

The second option considered was a heavier presalvage cut to remove more low-vigor trees, recover more of the projected loss, and have a healthier (faster growing) residual stand. In these scenarios we considered presalvage thinning to a level which would maximize available growing space while maintaining recommended stocking levels (the B-line or 60% relative stocking). Of the 38 stands used in the analysis, 31 qualified for such management in 1997. Following this simulated removal in 1997, we projected stand growth through the 1998-2007 decade and again compared the differences between the light and heavy outbreak scenarios and the no-outbreak scenario obtaining the results shown in Table 4.

Table 4. Losses due to gypsy moth defoliation following presalvage thinning to the 60-percent line for the 31 stands that will be at least 70 percent of fully stocked in 1997.

Stand Category	Trees Lost	Stocking Reduction	Basal Area Loss	Volume Loss
	trees/ac	percentage	sq. ft./ac	MBF/ac
			Heavy Outbreak	
Average	[29.5]	27.6	32.4	2.1
Best	[80.0]	15.0	22.0	1.5
Worst	14.0	39.0	41.3	2.7
			Light Outbreak	
Average	2.7	1.5	1.9	0.1
Best	[4.0]	1.0	1.1	0.0
Worst	7.0	3.0	3.8	0.3

This level of presalvage thinning further reduces the overall impact of gypsy moth. It should be noted that the assumption here has not been to reduce the severity of defoliation, but rather to reduce the expected level of tree mortality by removing trees expected to die as a result of a gypsy moth

outbreak. Preventative treatments offer substantial economical savings and improves the overall health of the residual forest. Enhanced by increased growing space and nutrient availability, both regeneration and residual trees respond by improved growth and vigor. Furthermore, these conditions improve the tree's chances to recover from defoliation with minimal damage, as is demonstrated in the heavy outbreak scenarios when we compare the average stocking among these three tables. Loss in stocking drops from a 45.2% loss with no management, to 38% when lightly thinned, and to a 27.6% loss when these forest management practices are used to remove the most vulnerable trees. The end result could almost double the amount of healthy forest canopy in the average stand. To permit direct comparisons with Tables 2 and 3, we again summarized just the 24 heaviest stocked stands after cutting to the B line.

Table 5. Losses due to gypsy moth defoliation following presalvage thinning to the 60-percent line for the 24 stands that will be at least 90 percent of fully stocked in 1997.

Stand Category	Trees Lost	Stocking Reduction	Basal Area Loss	Volume Loss
	trees/ac	percentage	sq. ft./ac	MBF/ac
			Heavy Outbreak	
Average	[30.2]	28.8	33.0	2.2
Best	[80.0]	22.0	26.6	1.9
Worst	[3.0]	39.0	41.3	2.7
			Light Outbreak	
Average	2.7	1.7	2.1	0.2
Best	[1.0]	1.0	1.1	0.1
Worst	7.0	3.0	3.8	0.3

Note that basal area and volume losses increased only slightly over the values in Table 4. Contrasting these averages with those of Tables 2 and 3 show that increased intensity of presalvage thinning will increase the savings in the residual stands. Basal area losses are reduced by 30% under light thinning and by 47% under this B-line thinning. Similarly volume savings would be 24% under light thinning and 55% under this B-line thinning. Throughout these analyses we have concentrated on the standing timber and the residual stands, not considering the revenue generated nor any other value estimates for timber removed during these presalvage thinnings.

We examined our results using analysis of variance techniques to explore variation among these oak-hickory forest types and found no significant differences among forest types, either following defoliation episodes or following presalvage thinning and defoliation episodes. Thus, we conclude that these data can be applied across the area and that they represent the range of expected future impacts that gypsy moth will cause as it becomes established in the Dorr Run Area.

Citations

Anonymous. 1995. Gypsy moth management in the United States: a cooperative approach: Final environmental impact statement, November 1995. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Area State and Private Forestry. Vol. I-V.

Colbert, J.J. 1997 in review. Potential gypsy moth damage: analysis for the Wayne National Forest. Fosbroke, Sandra L. C., Gottschalk, Kurt W., eds. Proceedings, U.S. Department of Agriculture interagency gypsy moth research forum 1997; 1997 January 14-17; Annapolis, MD. Gen. Tech. Rep. NE-xxx. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 8 p.

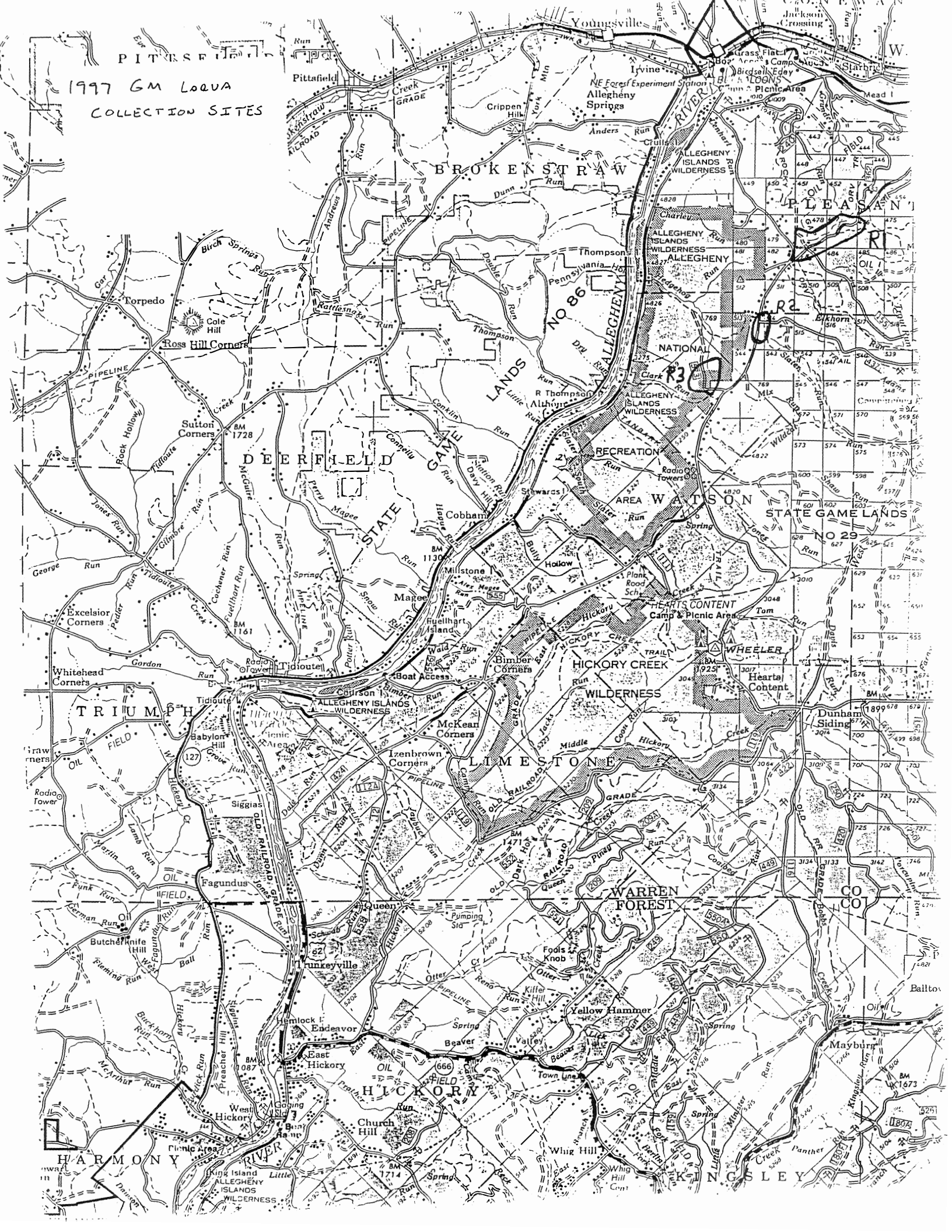
Gottschalk, Kurt W. 1993. Silvicultural guidelines for forest stands threatened by the gypsy moth. Gen. Tech. Rep. NE-171. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 49 p.

Gottschalk, Kurt W.; MacFarlane, W. Russ. 1992. Photographic guide to crown condition in oaks: use for gypsy moth silviculture. Gen. Tech. Rep. NE-168. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 8 p.

Liebhold, Andrew M.; Gottschalk, Kurt W.; Muzika, Rose-Marie; Montgomery, Michael E.; Young, Regis; O'Day, Kathleen; Kelly, Brooks. 1995. Suitability of North American tree species to gypsy moth: a summary of field and laboratory tests. Gen. Tech. Rep. NE-211. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 34 p.

Liebhold, Andrew M.; Gottschalk, Kurt W.; Luzader, Eugene R.; Mason, Douglas A.; Bush, Renate; Twardus, Daniel B. 1997. Gypsy moth in the United States: an atlas. Gen. Tech. Rep. NE-233. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 36 p.

Stout, S. L. and R. D. Nyland. 1986. Role of species composition in relative density measurement in Allegheny hardwoods. Can. J. For. Res. 16: 574-579.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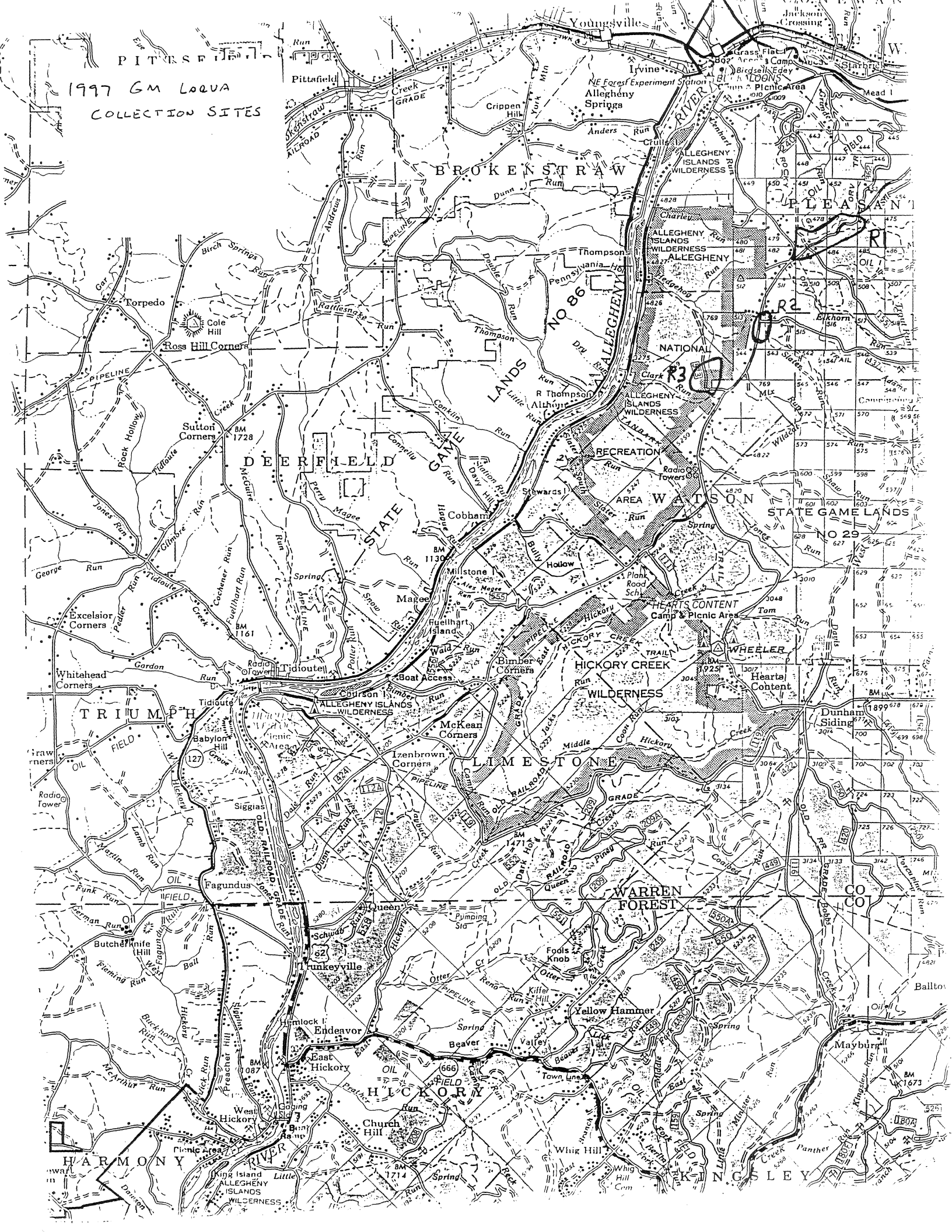
PITTSFIELD
1997 GM LOQUA
COLLECTION SITES
Youngsville
Jackson Crossing
Grass Flat
Irvine
Starbrick
Pittafield
NE Forest Experiment Station
Allegheny Springs
Crippen Hill
Crulls
BROKEN STRAW
ALLEGHENY ISLANDS WILDERNESS
PLEASANT
Thompson
Pennsylvania
ALLEGHENY NO 86
Torpedo
Cole Hill
Ross Hill Corners
Rattlesnake Run
Thompson Run
NATIONAL
R1
R2
R3
Elkhorn
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STATE GAME LANDS
NO 29
Sutton Corners
BM 1728
DEERFIELD
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Connelly Run
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Stewards
Cobham
Millstone
Magee
Fuellhart Island
Excelsior Corners
BM 1161
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Whitehead Corners
Radio Tower
Boat Access
Courson
Bimber Corners
HEARTS CONTENT
Camp & Picnic Area
WHEELER
BM 1925
HICKORY CREEK
WILDERNESS
Hearts Content
Dunham Siding
BM 1899
TRIUMPH
Babylon Hill
McKean Corners
Izenbrown Corners
LIMESTONE
Siggias
Fagundus
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Trunkeyville
Fools Knob
Yellow Hammer
Hemlock
Endeavor
East Hickory
West Hickory
Church Hill
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Whig Hill
Mayburn
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FOREST
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HARMONY
King Island
ALLEGHENY ISLANDS WILDERNESS
Little Panther Creek
Oil Field
Pipeline
Old Railroad Grade
Plank Road Sch
Tidioute Picnic Area
Ballto

1997 Gypsy Moth Larva Samples

11- Nov - 199

Site	Location	Number of Samples
51	Rocky Gap Trail	29
52	RT 337 / FR 437	2
53	FR 573	1